

- This versatile kit features TWO independent touch switch circuits.
- Configure for pushbutton or toggle switch operation.
- An economical alternative to expensive CW paddle devices.
- Create unique switches on door knobs, under tables, how about a plant leaf?!
- Design a 'friendly' switch for a handicapped person.

Dual Circuit Electronic • Touch Switch

Touch it once - it's on, touch again - it's off. This kit uses low power CMOS technology to sense your presence! Complete instructions guide you through assembly so you get a working unit every time. Also included are complete instructions to make a HAM radio CW paddle.



Kit No. TS1

INTRODUCTION TO THE TS1 TOUCH SWITCH

The TS1 circuit provides two completely independent touch-switch circuits, a feature which greatly enhances its usefulness. This dual-circuit design makes maximum use of its two 4000-series CMOS integrated circuits. Either circuit may be set up for your choice of momentary or toggle operation.

Touch it, and a light goes on. Touch it again, and the light goes off. Or, touch it just to ring a bell momentarily. One TS1 can do both - at the same time! In addition to thinking first about how we can use the novel TS1 Dual Touch Switch for our own tinkering, we can also take a serious look at how we electronics buffs can home-build useful devices for people who really would use, need and appreciate the special features of this circuit! This kit is an ideal foundation for really useful state-of-the-art devices helpful to people disabled by injuries or conditions such as acute arthritis. The simple act of turning a switch or trying to press a button can be a discouraging chore for some folks. We can help!

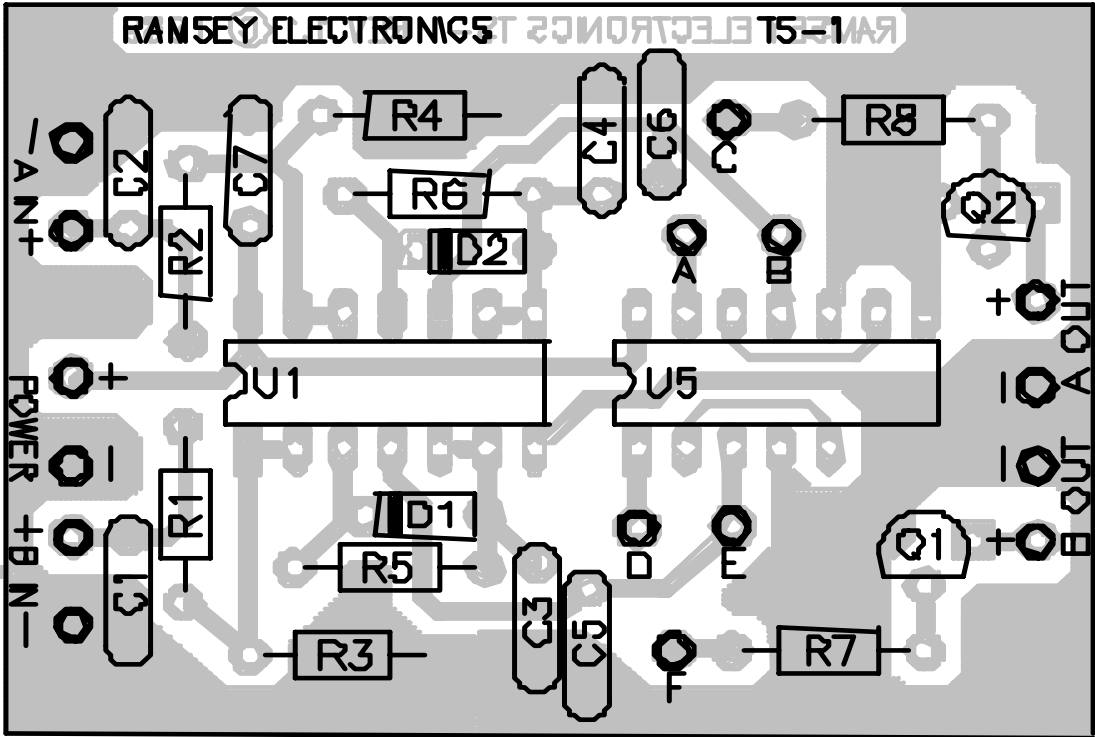
In this manual, we'll show you how to build the TS1 and then pass on a few ideas on how you can brighten somebody else's life with your home-crafted creativity and generosity. Also, the TS1 can be fun and educational. Think of the toys that can light up or make noises with just gentle touches in the right place! And, Ham operators can set it up to serve as a touch-style "paddle" unit for our popular CW7 CMOS Electronic Keyer.

PARTS LIST

- ❑ 4 .001 uF disc capacitors (marked .001, 102, or 1 nF) [C1,2,5,6]
- ❑ 1 .01 uF disc capacitor (marked .01, 103, or 10 nF) [C7]
- ❑ 2 .1 uF disc capacitors (marked .1 or 104) [C3,4]
- ❑ 4 10K ohm resistors (brown-black-orange) [R1,2,7,8]
- ❑ 2 1 Megohm resistors (brown-black-green) [R5,6]
- ❑ 2 22 Megohm resistors (red-red-blue) [R3,4]
- ❑ 2 NPN Transistors (2N3904 or similar) [Q1,2]
- ❑ 2 1N914 (or similar) diodes [D1,2]
- ❑ 1 4011 14-pin DIP CMOS IC [U1]
- ❑ 1 4013 14-pin DIP CMOS IC [U2]
- ❑ 1 Drilled PC-board (marked TS2)

Note on Identifying IC's: The 4011 and 4013 numbers may be imbedded within the part number of a particular manufacturer. Examples: "4011" = MC14011BCP or CD4011BCN, etc.

PARTS LAYOUT DIAGRAM



TOUCH SWITCH PC BOARD ASSEMBLY STEPS

- ❑1a. Since the two IC's are the heart of the circuit and also make the locations of additional parts easier to identify, they are installed first. The IC's may be soldered directly to the PC-board without worry, but if you prefer to use 14-pin IC DIP sockets, please solder the sockets and insert the IC's with all the same care that you would give to direct-soldering of the IC's.
- ❑1b. The layout of this PC-board is unusually symmetrical, a real work of art. Be sure that you have your empty board oriented exactly in accord with the Parts layout drawing before installing any parts!
- ❑2. Install U1, the 4011-type IC per Steps 1a-b above.
- ❑3. Install U2, the 4013-type IC per Steps 1a-b above.
- ❑4. Before proceeding, double-check PC-board and IC orientation, making sure that the direction of the notched or dotted ends of the IC's corresponds to the PC-board drawing!
- ❑5. Install C1, .001 uF (marked .001, 102, or 1 nF).
- ❑6. Install R1, 10K (brown-black-orange).

- ❑7. Install C2, .001 uF (marked .001, 102, or 1 nF).
- ❑8. Install R2, 10K (brown-black-orange).
- ❑9. Install C7, the sole .01 uF capacitor (marked .01, 103, or 10nF)
- ❑10. Install R3, 22 megohms (red-red-blue).
- ❑11. Install R5, 1 megohm (brown-black-green).
- ❑12. Install diode D1, making sure that the banded (cathode) is pointed to the input end of the board as illustrated.
- ❑13. Install R4, 22 megohms (red-red-blue).
- ❑14. Install R6, 1 megohm (brown-black-green).
- ❑15. Install diode D2, making sure that the banded (cathode) end is pointed to the input end of the board as illustrated.
- ❑16. Install C3, .1 uF (marked .1 or 104).
- ❑17. Install C5, .001 uF (marked .001, 102, or 1 nF).

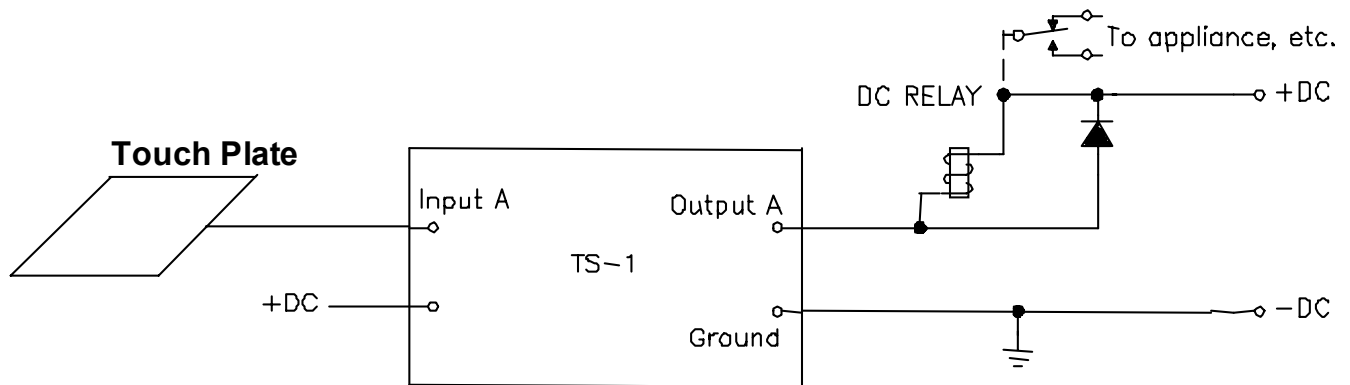
- ❑18. Install R7, 10K (brown-black-orange).
- ❑19. Install C4, .1 uF (marked .1 or 104).
- ❑20. Install C6, .001 uF (marked .001, 102, or 1 nF).
- ❑21. Install R8, 10K (brown-black-orange).
- ❑22. Install NPN transistor Q1. Be sure its flat side faces as shown on the PC-board drawing. Notice that both Q1 and Q2 face in the same direction. Firmly, but gently, press the transistor's three wires in their holes as far as possible before soldering.
- ❑23. Install transistor Q2, the other 3904 type transistor.
- ❑24. Recheck your work, and make sure that jumper wire holes A through F, as well as the 8 input and output points, have not been used for components, per the PC board drawing.

FINAL CONNECTIONS AND TESTING

- 25. The time has now come to determine which mode of operation you prefer - momentary or toggle. Since the TS1 contains two circuits, one of each may also be selected. For circuit 'A', connect a "jumper" wire between points B and C for a momentary switch, or between points A and C for a toggle switch. For circuit 'B', jumper between points E and F for momentary operation, D and F for a toggle switch.
- 26. The inputs should be wired to some sort of sensor plate, which consists of a metal surface that is easy and pleasant to touch. This sensor plate must be insulated from the TS1 ground or DC.
- 27. Connect 8 - 12 VDC to the PC board. The (+) connection is labeled 'P' on the circuit board, and the (-) connection is adjacent to it. Check the parts layout diagram for proper installation.

Initial testing may be done by simply connecting a VOM to the base of each output transistor to verify desired switching action. Note that each output is an 'open collector' type. When the base voltage is high' (about .7VDC) the output transistor will sink current. Be sure to wire the jumpers as desired for momentary or toggle action for both switch circuits.

Hookup and use of the TS1 requires a clear understanding of both the touch inputs and the output switching circuitry. The Q1 and Q2 transistor switches are not "perfect" 0 (on) and infinity (off) switches. While the collector-to-emitter resistance is several thousand ohms in the "off" situation, this resistance can still be up to 300 ohms when switched on, depending on supply voltage and individual transistor characteristics. Therefore, the use of a relay (see hookup illustration) is recommended.



Note: The diode (1N4001, 4002, etc.) is required in all relay applications, and the (-) DC of the relay power supply must be connected to the TS1 ground.

TROUBLESHOOTING HINTS

If your touch switch does not work, recheck the following:

- Correct orientation of all transistor flat sides.
- Correct resistor and capacitor placement, " that's not a 10K where a 1K should be?"
- All solder connections - this is the most frequent cause of failure. Check these connections under a bright light and use a magnifying lens. Touch up any connections that are less than perfect.

Note on C1 and C2: Provision is made for these bypass capacitors at both of the touch inputs as normal good engineering practice, particularly in high RF environments. In some cases, these bypass capacitors may interfere with or prevent reliable TS1 operation. This can occur in climates or seasons with very low static fields or perhaps environments with low AC hum levels. If this is the case, C1 and C2 may be removed from the circuit.

Out in the middle of "Nowhere"?

Reliable touch switch operation depends on your body passing on to the touch inputs some of the 60 Hz AC energy that's usually all around us, or a bit of static electricity, or a combination of both.

So, if you are enjoying portable operation at a site that is beautifully and serenely out in the middle of nowhere, it is possible that the touch inputs will not work correctly. Such a situation can be remedied by designing "dual" touch contacts in such a way that your fingers bridge both the touch inputs and (+) DC, which will supply the needed high to the 4011 IC inputs.

TS1 APPLICATIONS

Building Devices for People with Disabilities

There would be three considerations in designing switching systems for disabled persons:

1. Safety (i.e., isolation from AC circuits).
2. Convenient location of the touch plates.
3. Logical separation of the touch plates.

These are "obvious" considerations, so here's just one thought about No. 3 as an example. Let's say that one switch is supposed to turn a night lamp or bedside lamp on or off, and the other one rings a bell to call for assistance. You would want to design your system in such a way that the person would not be ringing the bell by accident while trying to turn on a light. Several TS1 kits could be used to create a sort of touch-control "panel" for easy operation of several lights, TV, radio, fans, signal bell, or several bells, each with their own meaning. Just be sure that the object to be handled or touched involves only low-level DC, with all relays and AC-wiring safely enclosed and out of the way.

Touch Keyer Paddle

The TS1 Touch Paddle is a direct application of the TS1 Dual Touch Switch Kit and is intended to be an economical mate for the Ramsey CW-7 E-Z CMOS Electronic Keyer.

The CW-7 lets electronic switching take over the basic task of generating perfectly-formed Morse dits and dahs. The TS1 Touch Keyer puts electronics to further work by letting easy finger touches take over the mechanical switching functions of "keyer" paddles." As we point out in the CW-7 instruction manual, today's typical keyer paddle device can cost more than the electronic keyer itself, so we do provide some ideas in that booklet on making your own first paddle from simple materials such as hacksaw blades or kitchen spreader knives.

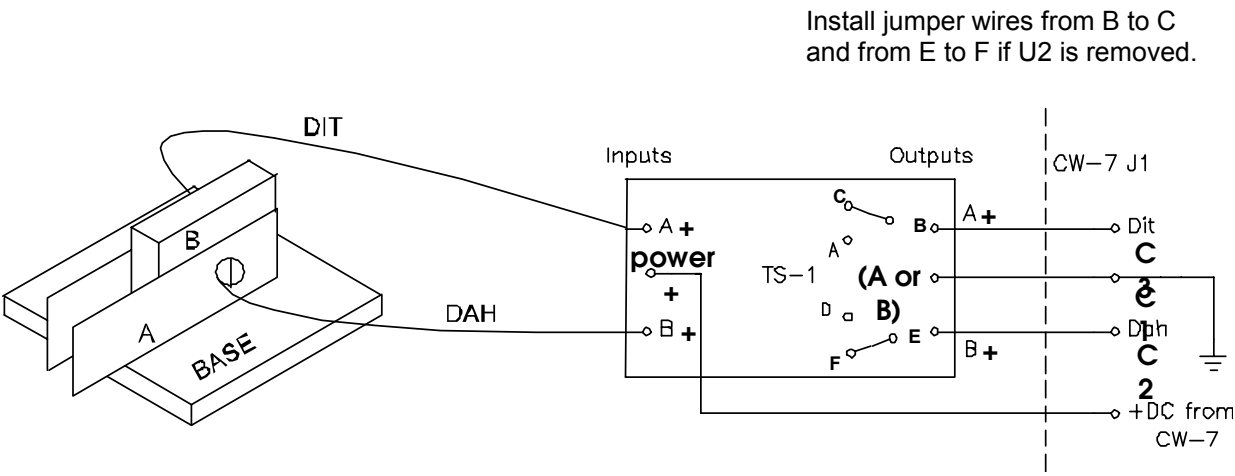
You will find the TS1 keyer paddle system to be better than anything else short of a finely-crafted mechanical device such as Bencher, Vibroplex and so forth. The reason is that there is no less-than-perfect mechanical movement between your touch and actual character formation. There is nothing to adjust except your own feel for your two fixed "paddle-contact" surfaces. It should take less than five minutes to get reasonably comfortable with this type of keying.

In fact, the main difference you'll find between the TS1 and other keyer paddles is just that you can't rest your fingers on the paddle contact surfaces when not sending!

Hookup & Operation

If you prefer, the 4013 IC (U2) need not even be installed for this application. It is best to mount the TS1 board inside the CW-7 case. This eliminates the need for extra wires to supply DC voltage. A two-conductor wire from the touch inputs to the Touch contact assembly is ordinarily sufficient. Shielded wire may be needed if there is excessive RF floating around. With the TS1 touch-keying system, you can concentrate fully on good character formation. The Contact Block can be anything that looks right and works right for you. You may prefer that your touch keying assembly closely resemble a mechanical keyer paddle, or you may have an entirely different design in mind. Let the following sketch serve simply as a starting point:

TS1 KEYER DIAGRAM



TS1 CIRCUIT DESCRIPTION

Notice that the TS1 consists of two identical circuits, A and B. The explanation of Circuit A applies to both. DC voltage (+9 to 12) is supplied to pin 14 of each IC. U1 and Q1 perform the momentary switching (jumper B to C). U2 is involved only when toggle mode is desired (jumper A to C).

Pins 1 and 2 of U1 are normally at a low (ground) potential, so pin 3 will be high (+DC). When pin 3 is high, C3 is charged through the 1 megohm resistor (R5), so that pins 5 and 6 will be high, making pin 4 low. With pin 4 low, jumper point "B" is also low. Jumper point "A" from U2 is initially low. Therefore jumper point "C" to the base of Q1 will also be initially low for either jumper arrangement. With point C low, the output from Q1 is off.

When the input is touched, the normal electric fields picked up by your body force pins 1 and 2 of U1 high. The source of these fields is power line radiation or static electricity, or both. When pins 1 and 2 are high, pin 3 goes low, which pulls pins 5 and 6 low. Pin 4 and jumper point B therefore become high.

Transistor switch Q1 turns on whenever jumper point C becomes high. When your finger is removed from the input point, all U1 voltages revert to the initial state. However, no change will happen in U2 until the input is touched again. When [C] of U2 goes from low to high, the [Q] output remains high even when [C] returns to low. For [Q] to go low, [C] must receive a new high from U1.

CONCLUSION

If you've enjoyed this kit, be sure to check out the entire Ramsey kit line. We have a whole series of hobby and electronic kits that not only teach state-of-the-art technology, but are fun and easy to build, too! Call or write for our free catalog.

The Ramsey Kit Warranty

Please read carefully BEFORE calling or writing in about your kit. Most problems can be solved without contacting the factory.

Notice that this is not a "fine print" warranty. We want you to understand your rights and ours too! All Ramsey kits will work if assembled properly. The very fact that your kit includes this new manual is your assurance that a team of knowledgeable people have field-tested several "copies" of this kit straight from the Ramsey inventory. If you need help, please read through your manual carefully. All information required to properly build and test your kit is contained within the pages!

1. DEFECTIVE PARTS: It's always easy to blame a part for a problem in your kit, Before you conclude that a part may be bad, thoroughly check your work. Today's semiconductors and passive components have reached incredibly high reliability levels, and it's sad to say that our human construction skills have not! But on rare occasions a sour component can slip through. All our kit parts carry the Ramsey Electronics Warranty that they are free from defects for a full ninety (90) days from the date of purchase. Defective parts will be replaced promptly at our expense. If you suspect any part to be defective, please mail it to our factory for testing and replacement. Please send only the defective part(s), not the entire kit. The part (s) MUST be returned to us in suitable condition for testing. Please be aware that testing can usually determine if the part was truly defective or damaged by assembly or usage. Don't be afraid of telling us that you 'blew it', we're all human and in most cases, replacement parts are very reasonably priced.

2. MISSING PARTS: Before assuming a part value is incorrect, check the parts listing carefully to see if it is a critical value such as a specific coil or IC, or whether a RANGE of values is suitable (such as "100 to 500 uF"). Often times, common sense will solve a mysterious missing part problem. If you're missing five 10K ohm resistors and received five extra 1K resistors, you can pretty much be assured that the '1K ohm' resistors are actually the 'missing' 10 K parts ("Hum-m-m, I guess the 'red' band really does look orange!").

Ramsey Electronics project kits are packed with pride in the USA. If you believe we packed an incorrect part or omitted a part clearly indicated in your assembly manual as supplied with the basic kit by Ramsey, please write or call us with information on the part you need and proof of kit purchase.

3. FACTORY REPAIR OF ASSEMBLED KITS:

To qualify for Ramsey Electronics factory repair, kits MUST:

1. NOT be assembled with acid core solder or flux.
2. NOT be modified in any manner.
3. BE returned in fully-assembled form, not partially assembled.
4. BE accompanied by the proper repair fee. No repair will be undertaken until we have received the MINIMUM repair fee (1/2 hour labor) of \$18.00, or authorization to charge it to your credit card account.
5. INCLUDE a description of the problem and legible return address. DO NOT send a separate letter; include all correspondence with the unit. Please do not include your own hardware such as non-Ramsey cabinets, knobs, cables, external battery packs and the like. Ramsey Electronics, Inc., reserves the right to refuse repair on ANY item in which we find excessive problems or damage due to construction methods. To assist customers in such situations, Ramsey Electronics, Inc., reserves the right to solve their needs on a case-by-case basis.

The repair is \$36.00 per hour, regardless of the cost of the kit. Please understand that our technicians are not volunteers and that set-up, testing, diagnosis, repair and repacking and paperwork can take nearly an hour of paid employee time on even a simple kit. Of course, if we find that a part was defective in manufacture, there will be no charge to repair your kit (But please realize that our technicians know the difference between a defective part and parts burned out or damaged through improper use or assembly).

4. REFUNDS: You are given ten (10) days to examine our products. If you are not satisfied, you may return your unassembled kit with all the parts and instructions and proof of purchase to the factory for a full refund. The return package should be packed securely. Insurance is recommended. Please do not cause needless delays, read all information carefully.



RAMSEY TRANSMITTER KITS

- FM10A, FM25B FM Stereo Transmitters
- AM1, AM25 AM Transmitters

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- AR1 Aircraft Band Receiver
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- AA7 Active Antenna
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- TG2 DTMF Tone Grabber

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TOTAL SOLDER POINTS

86

ESTIMATED ASSEMBLY TIME

Beginner 2.6 hrs

Intermediate 1.5 hrs

Advanced..... 1.1 hrs

REQUIRED TOOLS

- Soldering Iron Ramsey WLC100
- Thin Rosin Core Solder Ramsey RTS12
- Needle Nose Pliers Ramsey MPP4 or RTS05
- Small Diagonal Cutters Ramsey RTS04
<OR> Technician's Tool Kit TK405

ADDITIONAL SUGGESTED ITEMS

- Holder for PC Board/Parts Ramsey HH3
- Desoldering Braid Ramsey RTS08
- Digital Multimeter Ramsey M133

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